

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL

TESTER, IGNITER CIRCUIT

(ALLEGANY INSTRUMENT COMPANY MODEL 101-5BF)

(MODEL 101-5BF)

(4925-712-0205)



HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTEMBER 1966

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 29 September 1966

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Units org under fol TOE:
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 6-615
 6-617
 9-51
 9-87
 9-377
 9-500 (FD)

NG: None

USAR: None.

For explanation of abbreviations used, see AR 320-50.

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DEPARTMENT OF THE ARMY
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**Operator's Manual
TESTER, IGNITER CIRCUIT
(ALLEGANY INSTRUMENT COMPANY
MODEL 101-5BF)
(4925-712-0205)**

TM 9-4925-226-10, 29 September 1966, is changed as follows:

Page 4. Add the following paragraphs:

Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, (Recommended Changes to Publications) and forwarded direct to Commander, US Army Weapons Command, ATTN: AMSWEMAS-SP, Rock Island, IL 61201.

Components of the End Item

Parts included with the end item and considered as components of the end item configuration are listed in the following table:

Table 1. Components of the End Item

| <i>Component</i> | <i>Part No.</i> | <i>(FSCM)</i> | <i>Qty</i> |
|-------------------------|------------------------|----------------------|-------------------|
| BATTERY, MERCURY: | RM12RT2 | (90303) | 1 |

Page 15. The appendix is superseded as follows:

**APPENDIX
BASIC ISSUE ITEMS LIST
AND
ITEMS TROOP INSTALLED OR AUTHORIZED LIST**

The basic issue items and items troop installed or authorized lists are not applicable.

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VERNE L. BOWERS
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CREIGHTON W. ABRAMS
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Armies (3) except
 Seventh (5)
 Eighth (5)
AMC (12)
OS Maj Comd (2)
LOGCOMD (2)
WECOM (10)
AVSCOM (2)
Ft Knox FLDMS (10)
BGDA (2)
MICOM (1)
LEAD (2)
USACOMZEUR (1)
USAFAS (2)
USACDCEC (10)
USAMMCS (5)
USASETAF (1)
USARJ (2)
USARYIS (2)
Units org under fol TOE:
 6-615 (2)
 6-617 (2)

NG: State AG (3)

USAR: None

For explanation of abbreviations used, see AR 310-50.

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A WORD ABOUT SAFETY.....

THE INSTRUMENT DESCRIBED IN THIS MANUAL IS A PRECISION DEVICE USED TO MEASURE THE RESISTANCE OF HAZARDOUS CIRCUITS.

SINCE THIS INSTRUMENT IS USED PRIMARILY FOR TESTING OF HAZARDOUS CIRCUITS, IT IS STRONGLY EMPHASIZED THAT SHOULD ANY REPAIRS BE NECESSARY, EXTREME CARE SHOULD BE EXERCIZED AND REPAIR OR ADJUSTMENT BE UNDERTAKEN ONLY BY QUALIFIED TECHNICIANS. ANY ALTERATION OR SUBSTITUTION WHATSOEVER OF THE WIRING OR COMPONENTS OF THIS INSTRUMENT MAY JEOPARDIZE THE SAFETY OF PERSONNEL AND PROPERTY.

SECTION I: GENERAL DESCRIPTION

1. Introduction:

The Model 101-5BF Igniter Circuit Tester is a stable, precision instrument designed primarily for the preflight testing of solid-fuel rocket-engine igniter bridge-wires for open or short-circuit conditions. Its use extends to the testing of various other detonators with low-resistance bridge-wire characteristics, such as explosive bolts. The tester insures the reliability of explosive bolts, which, for example, play a vital role when utilized to separate booster stages after rocket launching.

The tester is mounted in a compact weatherproof case and has a carrying handle which affords complete portability. The clip-on case cover is easily removed and all controls and terminals are convenient and accessible. The case is fitted with rubber pads so that the tester can sit in a horizontal or vertical position without damage to the case or the surface on which it is placed.

The basic circuit of this instrument is a modified version of the well-known Wheatstone Bridge. This time-tested circuit, the standard of instrumentation, assures the continued stability and reliability realized in the past.

Maximum accuracy of the tester can be realized if the firing leads to the igniter proper are isolated and their resistance measured. This permits an accurate calculation of the true resistance of the igniter.

2. Specifications:

| | |
|--|--|
| RANGE: | 0-30 ohms |
| (1) PHMS ADD Dial: (10-ohm increments) | 0-20 ohms |
| (2) OHMS Dial: (Continuous) | 0-10 ohms |
| ACCURACY: | |
| 0-5 ohms: | ± 0.02 ohm accuracy |
| 5-30 ohms: | ± 0.05 ohm accuracy |
| MAXIMUM CURRENT: | 0.005 ampere |
| BATTERY LIFE: | one year |
| SIZE: | 7-3/4"L. x 4-1/4"W. x 3-3/4"D. (overall size with cover and feet is 8-5/8"L. x 5-1/16"W. x 5-3/4"D.) |
| WEIGHT: | Four pounds |

3. Inspection for Damages:

The tester is packed for the utmost protection against shock during shipment. Upon receipt of the tester, it should be removed from its shipping carton and inspected for any damages which may have been incurred during transportation.

Open the overpack container and remove the innerpack. Open the second carton, being careful not to damage the enclosed tester by the use of sharp tools, and remove it with the protective wrappings. The unit may now be taken from the polyethylene cover and tuflex wrapping for inspection. The shorting bar that has been placed across the binding posts to protect the galvanometer should not be disconnected at this time.

SECTION II: THEORY OF OPERATION

1. Functional Description:

The basic circuit of the Igniter circuit Tester is a modified 'Wheatstone Bridge as shown in Figure 1. The igniter circuit to be measured forms the unknown arm of the bridge, while resistors R-3, R-4, and R-5 form the balancing arm. Bridge arms R-1 and R-2 are in the ratio of one to ten; therefore, the igniter circuit is one-tenth the resistance value of that in the balancing arm when a balanced state of the Wheatstone Bridge has been effected. Front panel controls, OHMS and OHMS ADD, indicate the igniter circuit resistance value directly in ohms which is their cumulative value.

2. Circuit Description:

The schematic diagram (Figure 1) shows circuit details of the instrument. With an igniter circuit connected to the measuring arm of the bridge, J-1 and J-2, depressing switch S-1 applies excitation voltage from B-1 to the bridge input and places the galvanometer (M-1) across its output. Adjusting S-2 and R-3 for null voltage indication on the galvanometer balances the bridge and presents a front panel indication of the igniter circuit resistance on the OHM-S and OHMS ADD dials. Shunt resistor R-6 protects the galvanometer from damage by damping the coil when it is disconnected from the circuit. R-7 limits the bridge current and in turn the igniter current to 5 milliamperes.

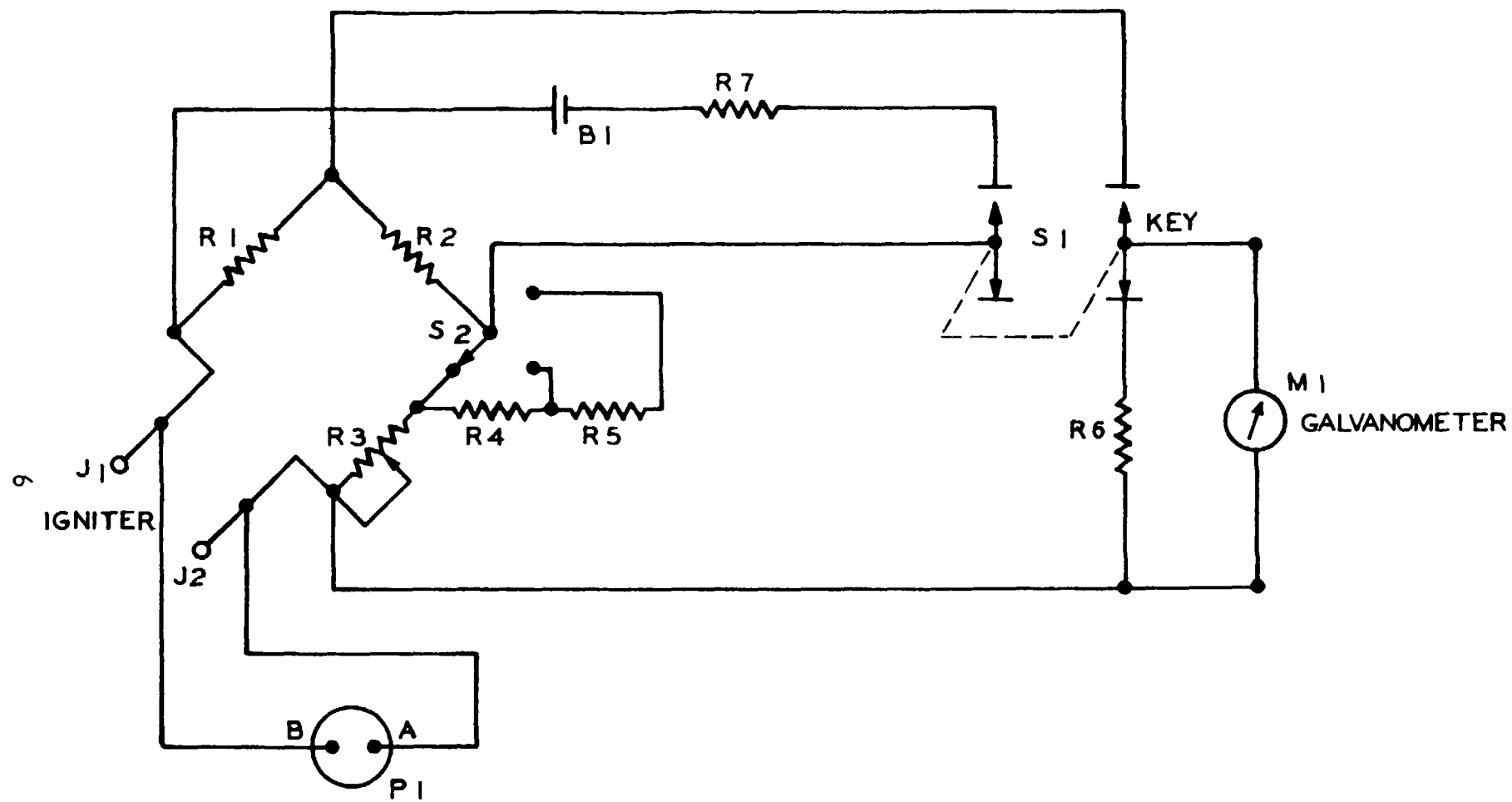


FIG. 1

SECTION III: OPERATION

1. Front Panel Controls and Connections (Figure 2):

a. Connections:

- (1) The only connections required for the operation of the igniter circuit tester is that of the igniter circuit to the binding posts labeled IGNITER CIRCUIT: Optional connection can be made to P-1, the two-pin AN connector on the end of the tester case. Igniter leads from this connector are terminated at the same points in the tester circuit as those from the binding posts.

b. Controls:

- | | |
|----------------------|--|
| (1) MECHANICAL ZERO: | Screwdriver adjustment on the galvo face for obtaining mechanical zero of the needle on the scale. |
| (2) OHMS ADD: | Rotary switch to change resistance measurements in 10-ohm increments to 20 ohms. |
| (3) OHMS | Ten-turn potentiometer with digital indication to change resistance measurements continuously from "0" to "10" ohms. |
| (4) KEY: | Pushbutton switch to engage self-contained battery and galvanometer for normal resistance measurements. |

2. Operation:

- (1) Check the galvanometer for mechanical zero.
- (2) If the needle to the galvanometer does not rest on the center (zero graduation of the scale, rotate the zero adjustment located below the face of the meter in the appropriate direction to effect zero indication.

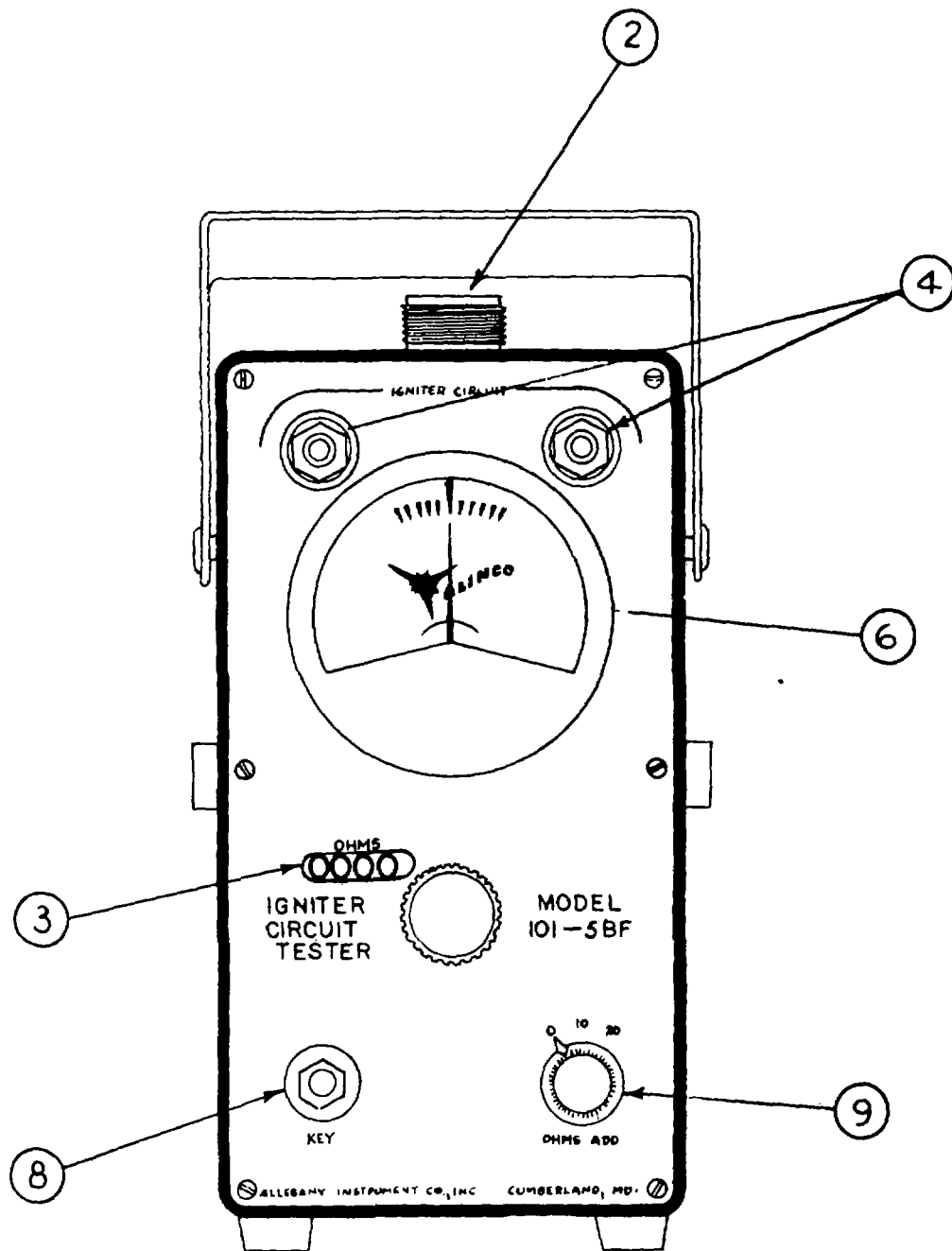


FIGURE 2

- (3) Remove the shorting bar from the input binding posts.
- (4) Connect the igniter circuit lines to the input receptacle or binding posts of the tester.
- (5) Set the cumulative OHMS dial and OHMS ADD control value for the igniter resistance expected.
- (6) Depress the operating key and rotate the OHMS control unit, until the galvanometer needle indicates zero.

NOTE

If the needle deflects to the right, the resistance setting of the dials is too high and must be changed in the direction of lower resistance (counterclockwise). In turn, if the needle deflects to the left, the resistance setting of the dials should be increased (clockwise).

WARNING

- (a) **The galvanometer in this instrument like all others is an extremely sensitive unit and can be damaged if overloaded, as indicated, by violent deflection of the indicator in either direction. For example, an open circuit will cause violent deflection to the left. Therefore, initial attempts to effect a galvanometer balance should be made by momentarily depressing the operating key for short durations until a balanced condition has been approached.**
 - (b) **The life of the digital indicator will also be shortened if it is rotated at an excessive rate of speed in order to overcome extreme off-resistance conditions.**
- (7) The value of the resistance measured by the tester is indicated as the sum of the OHMS and OHMS ADD dials. For example, if the OHMS dial setting is 1.25 and the OHMS ADD dial setting is 10, then the resistance of the circuit measured is $10 + 1.25$ or 11.25 ohms.

- (8) The resistance of the squib or igniter grid proper is calculated by subtracting the igniter circuit line resistance from the value obtained in (7) above.
- (9) The igniter circuit line resistance is readily determined by shortening the line at the igniter end and measuring its value with the tester as outlined in (4) through (7) above.

SECTION IV. MAINTENANCE

The Igniter Circuit Tester has been designed and constructed to be as rugged as is practical for a precision instrument. It will, therefore, provide maximum service for a long period of time if it receives the proper care that this type of equipment warrants.

The unit should be kept in a dry, dust-free location with its cover replaced when not in use. The binding posts should be cleaned periodically with a non-corrosive agent to ensure consistent measurements.

The illustrated parts utilized in Figures 2, 3, and 4, show the location of the basic parts utilized in the circuitry, but since the calibration of the tester is affected by the replacement of many components, except for replacement of the battery, field repairs are not recommended. If repairs do become necessary, refer the malfunction to the next higher category of maintenance.

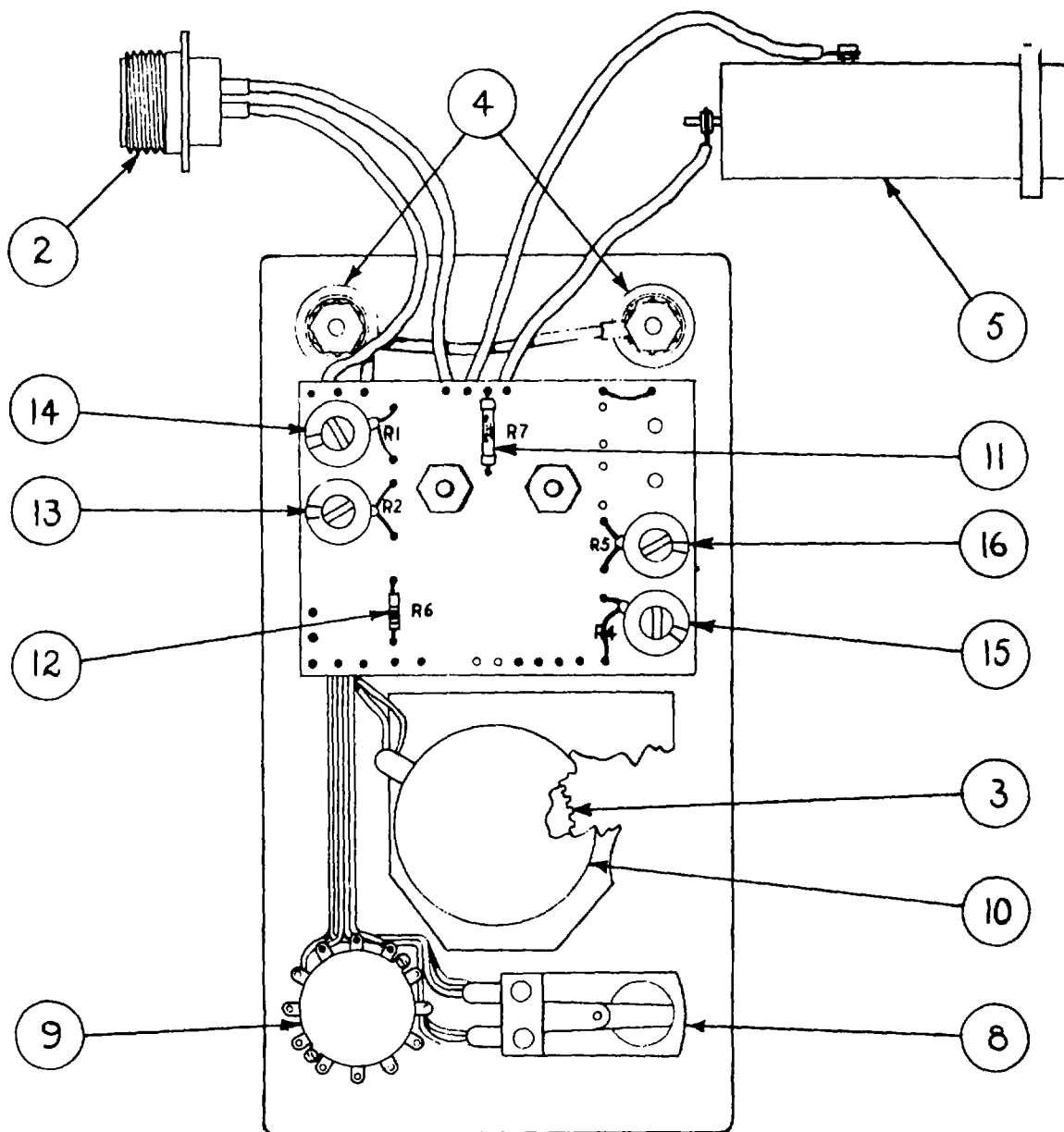


FIGURE 3

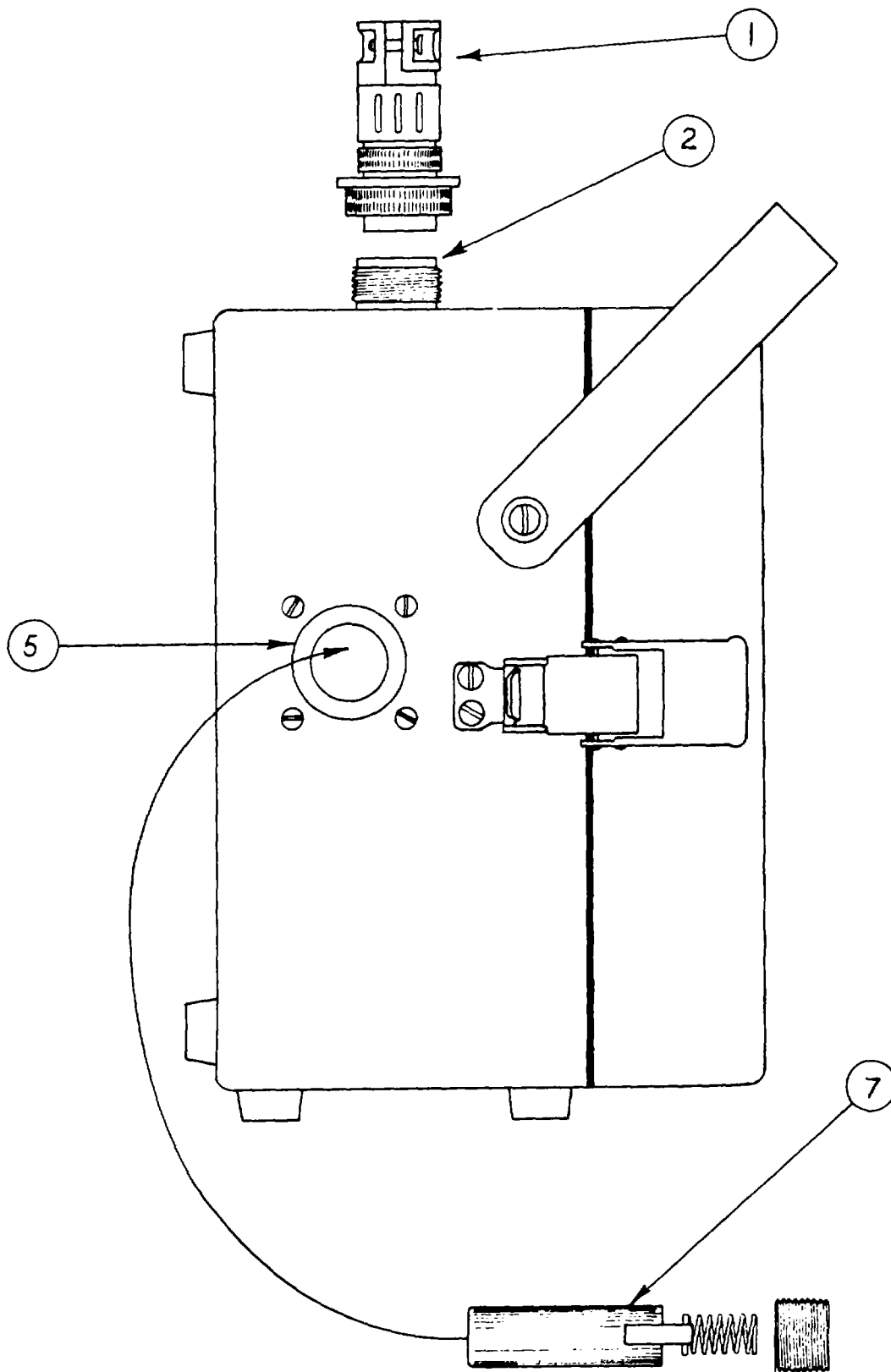


FIGURE 4

ILLUSTRATED PARTS IDENTIFICATION

(FIGURES 2, 3, and 4)

| <u>NUMBER</u> | | <u>PART NUMBER</u> |
|---------------|------------------------------|--------------------|
| 1 | AN Cable Commentor | P2 |
| 2 | AN Chassis Connector | P1 |
| 3 | Digital Dial Assembly | 1756 |
| 4 | Input Binding Posts | J1 & J2 |
| 5 | Battery Case Assembly | 1899 |
| 6 | Galvanometer | M1 |
| 7 | Mercury Battery | B1 |
| 8 | DPDT Pushbutton Switch | S1 |
| 9 | 1P 3 pos. Rotary Switch | S2 |
| 10 | 100-ohm Ten-turn Hilipot | R3 |
| 11 | 280-ohm Carbon Film Resistor | R7 |
| 12 | 470-ohm Carbon Resistor | R6 |
| 13 | 500-ohm Wire ground Resistor | R2 |
| 14 | 50-ohm Wire Around Resistor | R1 |
| 15 | 100-ohm Wire Wound Resistor | R4 |
| 16 | 100-ohm Wire Wound Resistor | R5 |

APPENDIX

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix is a list of basic issue items. It is composed of those items which make up the major end item of equipment and the operator's tools and equipment that are issued with the equipment and are required for stockage.

2. Explanation of Columns

a. *Source, Maintenance, and Recoverability Code (Colm 1).*

- (1) *Materiel code (col m 1a).* This column is not required.
- (2) *Source (col m 1b).* This column indicates the selection status and source for the listed item. Source code used in this list is:

| Code | Explanation |
|--------|---|
| P----- | Applied to repair parts which are stocked in or supplied from the FSA/DSA, or Army supply system, and authorized for use at indicated maintenance category. |

- (3) *Maintenance level (col m 1c).* This column indicates the category of maintenance authorized to install the listed item. Maintenance level code used in this list is:

| Code | Explanation |
|--------|-------------------------------|
| C----- | Operator and crew maintenance |

- (4) *Recoverability (col m 1d).* This column indicates whether unserviceable items should be returned for recovery or

salvage. When no code is indicated, the item will be considered expendable. Recovery code used in this list is:

| Code | Explanation |
|--------|---|
| R----- | Items which are economically repairable at direct and general support maintenance activities and are normally furnished by supply on an exchange basis. |

b. *Federal Stock Number (Colm 2).* Self explanatory.

c. *Description (Colm 3).* This column indicates the Federal item name (shown in capital letters) and any additional description required for supply operations. The manufacturer's code and part number are also included for reference.

| Code | Explanation |
|--------|--|
| 72665 | Mallory Battery Company |
| 99719. | Allegany Instrument Co. Div. of Textron Electronics, Inc. |

d. *Unit of Issue (Colm 4), Quantity Authorized (Colm 5), and Illustrations (Colm 6).* Self explanatory.

3. Errors, Comments, and/or Suggestions

Report of errors, comments, and/or suggestions are encouraged. They should be submitted on DA Form 2028 and forwarded direct to: Commanding General, Headquarters, U.S. Army Weapons Command, ATTN: AMSWESMM-P, Rock Island Arsenal, Rock Island, Ill. 61201.

Section II. BASIC ISSUE ITEMS

| (1) Source, Maintenance, and Recoverability Code | | | | (2) | (3) | (4) | (5) | (6) Illustration | |
|---|--------|---------------------------|--------------------------------|----------------------|--|---------------------|-------------------------------------|---------------------|----------------|
| (a) | (b) | (c) | (d) | Federal stock No. | Description | Unit of issue | Quantity Incorporated in unit | (a) | (b) |
| Material Code | Source | Mainten- ance level | Recover- ability ability | | | | | Figure Number | Item Number |
| | --- | --- | R | 4925-712-0205 | <p style="text-align: center;">MAJOR COMBINATION</p> <p>The major combination listed below is requisitioned for initial issue only.</p> <p>TESTER, IGNITER CIRCUIT: (Allegany Instrument Company Model 101-5BF) (4925-112-0205).</p> <p style="text-align: center;">COMPONENTS OF MAJOR COMBINATION: None authorized.</p> <p style="text-align: center;">SPARE PARTS: None Authorized.</p> <p style="text-align: center;">TOOLS AND EQUIPMENT FOR: TESTER, IGNITER CIRCUIT (99719: 101-5BF).</p> | | | | |
| P | | C | --- | 6135-725-3941 | <p>BATTERY, MERCURY: cylindrical, 1.35 v (72665:RM-12-RT2).</p> | EA | 1 | 4 | 7 |

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

| To change | To | Multiply by | To change | To | Multiply by |
|---------------|--------------------|-------------|--------------------|---------------|-------------|
| inches | centimeters | 2.540 | ounce-inches | newton-meters | .007062 |
| feet | meters | .305 | centimeters | inches | .394 |
| yards | meters | .914 | meters | feet | 3.280 |
| miles | kilometers | 1.609 | meters | yards | 1.094 |
| square inches | square centimeters | 6.451 | kilometers | miles | .621 |
| square feet | square meters | .093 | square centimeters | square inches | .155 |
| square yards | square meters | .836 | square meters | square feet | 10.764 |
| square miles | square kilometers | 2.590 | square meters | square yards | 1.196 |
| acres | square hectometers | .405 | square kilometers | square miles | .386 |
| cubic feet | cubic meters | .028 | square hectometers | acres | 2.471 |
| cubic yards | cubic meters | .765 | cubic meters | cubic feet | 35.315 |
| fluid ounces | milliliters | 29.573 | cubic meters | cubic yards | 1.308 |
| pints | liters | .473 | milliliters | fluid ounces | .034 |
| quarts | liters | .946 | liters | pints | 2.113 |
| gallons | liters | 3.785 | liters | quarts | 1.057 |
| ounces | grams | 28.349 | liters | gallons | .264 |
| pounds | kilograms | .454 | grams | ounces | .035 |
| short tons | metric tons | .907 | kilograms | pounds | 2.205 |
| pound-feet | newton-meters | 1.356 | metric tons | short tons | 1.102 |
| pound-inches | newton-meters | .11296 | | | |

Temperature (Exact)

| | | | | |
|----|------------------------|----------------------------|---------------------|----|
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |
|----|------------------------|----------------------------|---------------------|----|

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